# CRISSP - Customizable Recyclable International Space Station Packaging, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)


## ABSTRACT

The CRISSP Phase II effort will mature to TRL-6 recyclable launch packaging materials to enable sustainable in-space manufacturing on the ISS and future manned deep space missions. Our Phase I effort began by testing the recycling of current launch packaging materials, identifying several that are possible to recycle. We then prototyped concepts for sealable bags made with readily recyclable A.M. materials, including Ultem thermoplastic. We next developed a process for 3D printing customized containers having integral vibration-damping features, and performed testing that revealed this CRISSP packaging can provide vibration protection equivalent to or better than current foam packaging materials. To fabricate these containers, we developed novel 3D printer infills which can controllably provide a wide range of compression and flexing directions depending on the print parameters. For the highest performing infills, energy attenuation was up to two orders of magnitude better than that of a volumetrically equivalent amount of foam. We then demonstrated recycling of these test samples into 3D printer filament. The Phase II effort will mature the CRISSP technologies to flight-ready status by performing thorough materials-degradation studies to characterize the performance of the materials as a function of number of recycling iterations, maturing and optimizing our infill generation software to enable highly-automated design of customized CRISSP containers optimized for a given payload's vibration sensitivities, prototyping 3D printed packaging for a test-case vibration-sensitive payload, and then performing extensive environmental qualification testing to mature the technology to TRL-6 or better. The primary results of the Phase II effort will be a flight-ready process for packaging supplies and components for launch to ISS with materials that are readily recyclable on-orbit.



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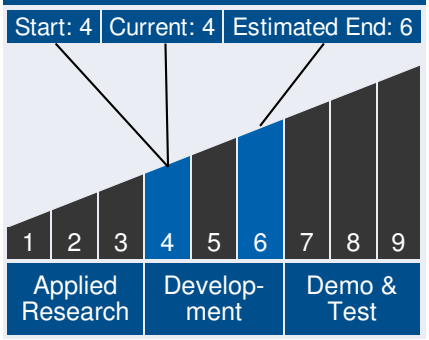
## Technology Maturity




## Management Team

**Program Executives:**

- Joseph Grant
- Laguduva Kubendran

**Program Manager:**

- Carlos Torrez

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## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: The CRISSP technology suite has multiple NASA applications which will enhance capabilities on the ISS and other long duration missions. The 3D printed packaging architecture can better attenuate launch vibrations than the foam materials already used, its frequency attenuation can be tuned for certain payloads, and it could better protect sensitive experiments from the overall launch vibration as well as from any specific harmful frequencies. After launch, the packaging can be recycled on-board to create 3D printer filament to enable sustainable in-space manufacturing of tools and satellite components.

### To the commercial space industry:

Potential Non-NASA Commercial Applications: The underlying technologies used in the CRISSP system have application outside the agency with other non-NASA space customers who also launch payloads into space. We will also reach out to DoD customers, such as the Navy, who are similarly limited to resupply during submarine missions. With the increasing number of 3D printer users as well as the increase in the shipping of goods to residential addresses, there is a lot of space for the CRISSP technology suite to revolutionize the packaging industry. In addition, the design and concept of CRISSP as it pertains to frequency attenuation is very well suited to frequency dampeners, opening a different use case for commercialization.

## Management Team *(cont.)*

**Principal Investigator:**

- Rachel Muhlbauer

## Technology Areas

**Primary Technology Area:**
Materials, Structures, Mechanical Systems and Manufacturing (TA 12)
└ Manufacturing (TA 12.4)
└ Sustainable Manufacturing (TA 12.4.4)

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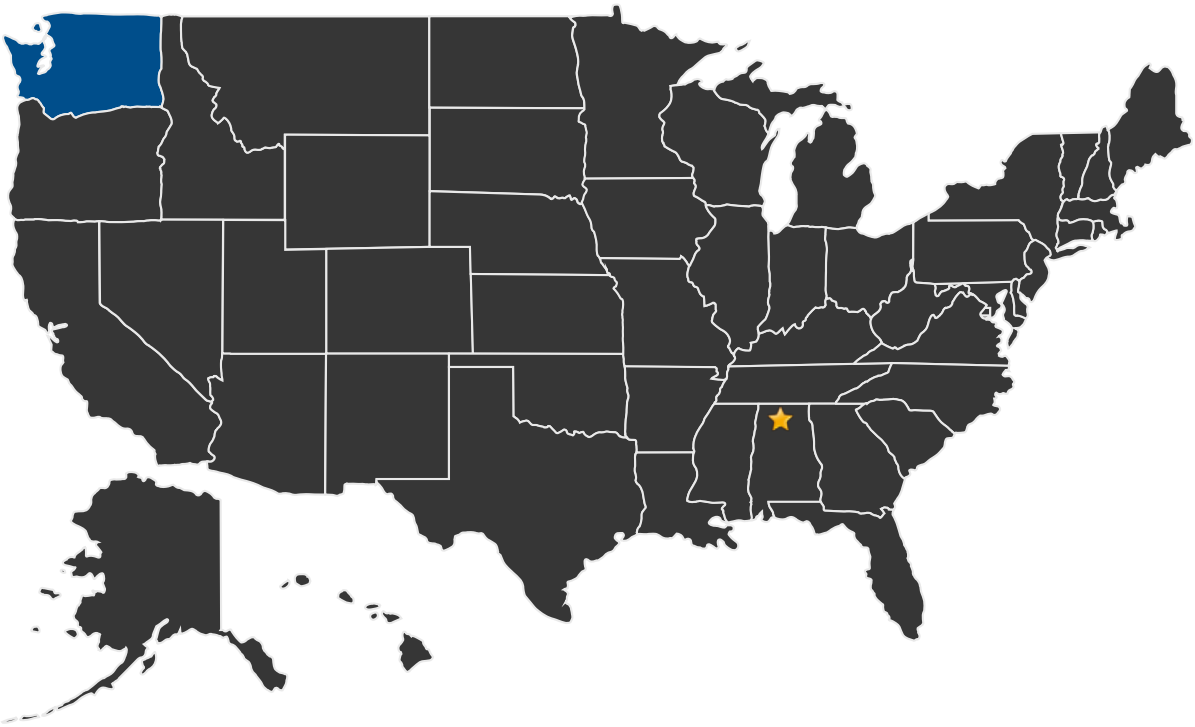
## U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

**Lead Center:**
Marshall Space Flight Center

**Other Organizations Performing Work:**

- Tethers Unlimited, Inc.  (Bothell, WA)

## PROJECT LIBRARY

**Presentations**

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23113)

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## IMAGE GALLERY


*CRISSP - Customizable Recyclable International Space Station Packaging, Phase II*

## DETAILS FOR TECHNOLOGY 1

### Technology Title

CRISSP - Customizable Recyclable International Space Station Packaging, Phase II

### Potential Applications

The CRISSP technology suite has multiple NASA applications which will enhance capabilities on the ISS and other long duration missions. The 3D printed packaging architecture can better attenuate launch vibrations than the foam materials already used, its frequency attenuation can be tuned for certain payloads, and it could better protect sensitive experiments from the overall launch vibration as well as from any specific harmful frequencies. After launch, the packaging can be recycled on-board to create 3D printer filament to enable sustainable in-space manufacturing of tools and satellite components.